GPS Leader™ In-vehicle Data Collection

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www.gpsleader.com

Battelle
Transportation

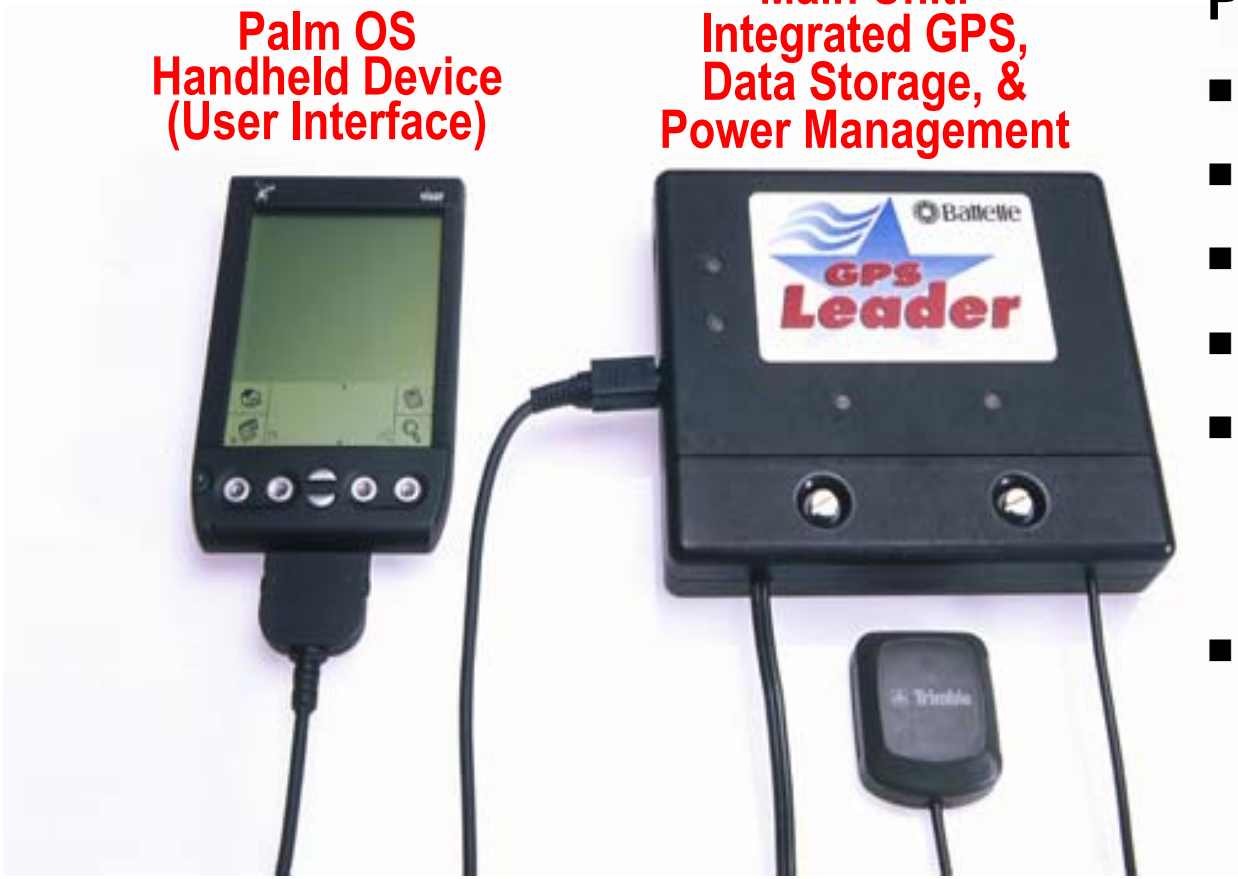
Presentation Overview

- Introduction
- Product features
- Application areas
- Discussion

GPS Leader™
An Innovative Device for Data Collection

- First commercially available GPS-based data collection device for traffic and transportation studies
- Designed for in-vehicle use
- Compact, rugged, highly integrated
- Customizable user interface for different data collection/ survey applications
- Advanced Battelle technology

Battelle's GPS Leader



Package Includes:

- Main unit
- Palm OS PDA
- GPS antenna
- Cables
- Software for downloading and managing data
- Documentation and video

GPS Leader Features

- GPS-based data collection device
- Data collected: (every second or less often)
  - Via the GPS receiver…
    - vehicle location in latitude & longitude
    - travel speed
  - Via the handheld user interface…
    - driver/occupants and trip purpose data
    - intersection or delay data
- Stores 5 to 7 days of detailed trip data for later download/analysis
  - Approximately 70 hours at the one-second level

Applications for In-Vehicle GPS Technology

- Personal or Household Surveys
  - Transportation Planning, Travel Demand Analysis

PTS

- Travel Time Studies
  - Congestion Management

TT/CMS

- Vehicle Activity Surveys
  - Commercial Truck Survey
- Emission Modeling and Duty Cycle Studies
  - Calibration for Microscopic Simulation, Evaluate Engine Stress to Improve Performance
- Fleet Performance / Operations Analysis
  - Evaluate Driver Behavior, Evaluate Fleet Productivity and Identify Areas of Improvement

AVAI

(automatic vehicle activity inventory)

Who Can Benefit from GPS Deployment?

- Transportation Planning Agencies
  - All levels: State, Region, County, City, and MPO
  - Collect detailed and accurate travel behavior data unavailable from traditional telephone survey
- Traffic Engineers
  - Automate and improve accuracy in travel time data collection for evaluating traffic signal timing and congestion management
- Commercial and Public Fleet Managers
  - Study fleet performance for improving operations of transit, public vehicles, commercial delivery vehicles, etc.
- Traffic/Transportation Researchers

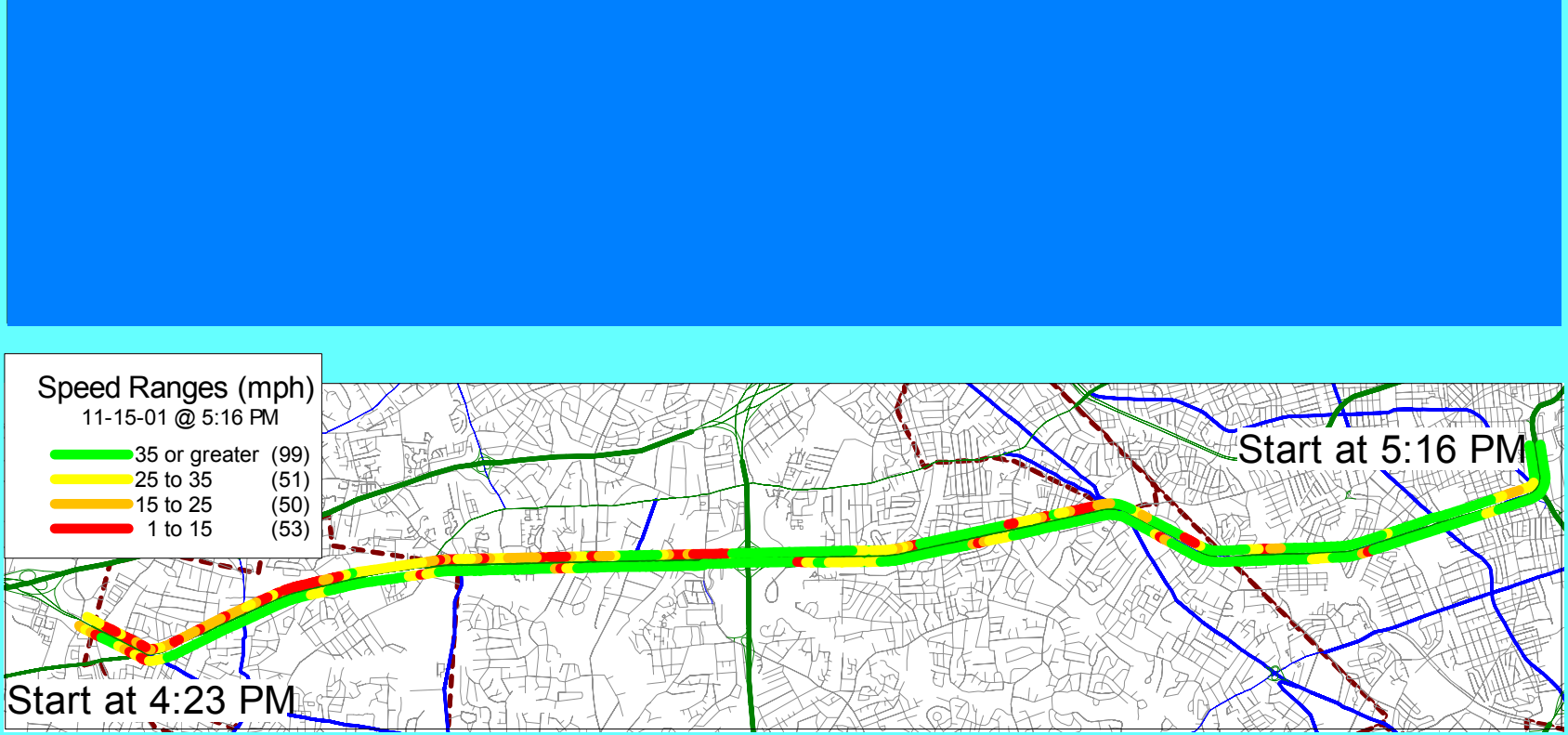
Travel Time Studies

- Systematic deployment on the local or regional transportation network for congestion management
- Identify specific points of delay and congestion
- Aggregate travel times on specific roadway segments
- Increase use at different periods (e.g., morning and afternoon peaks) for more detailed estimates
- More accurate than stopwatch method
- For some applications, requires only one person; can provide significant labor savings

Travel Time Studies

- Displays from GPS data collection using probe vehicles
- Summaries of travel time, speed, and delay
  - US 50 corridor in northern Virginia
  - Aggregate data for Alexandria, Virginia
  - Central Avenue in Phoenix, AZ

US 50 Travel Time Runs: Between Pershing Dr. and Waples Mill Rd.: Thur., Nov. 15, 2001



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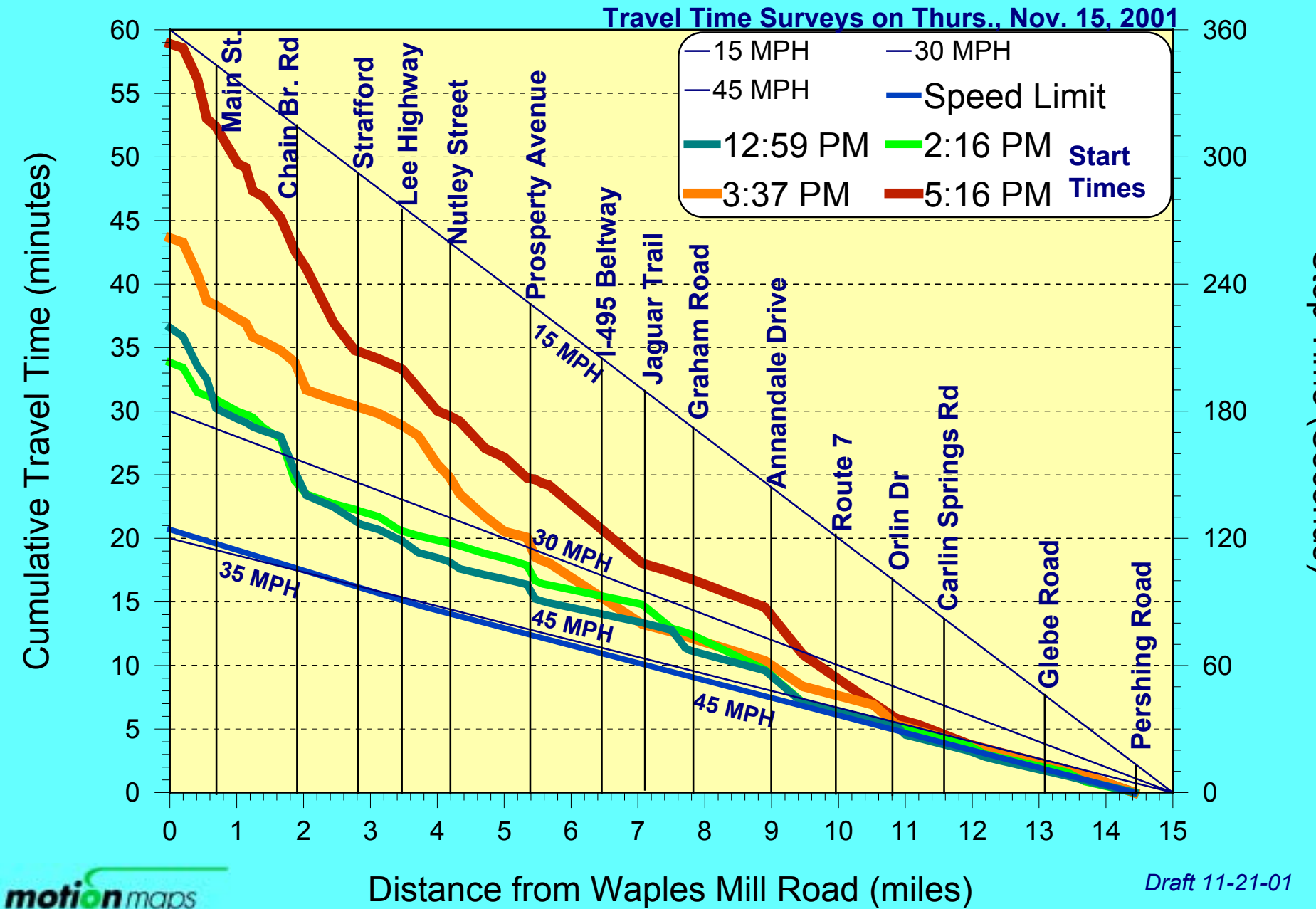
motionmaps

US 50 Travel Times: Pershing Dr to Waples Mill Rd: Westbound



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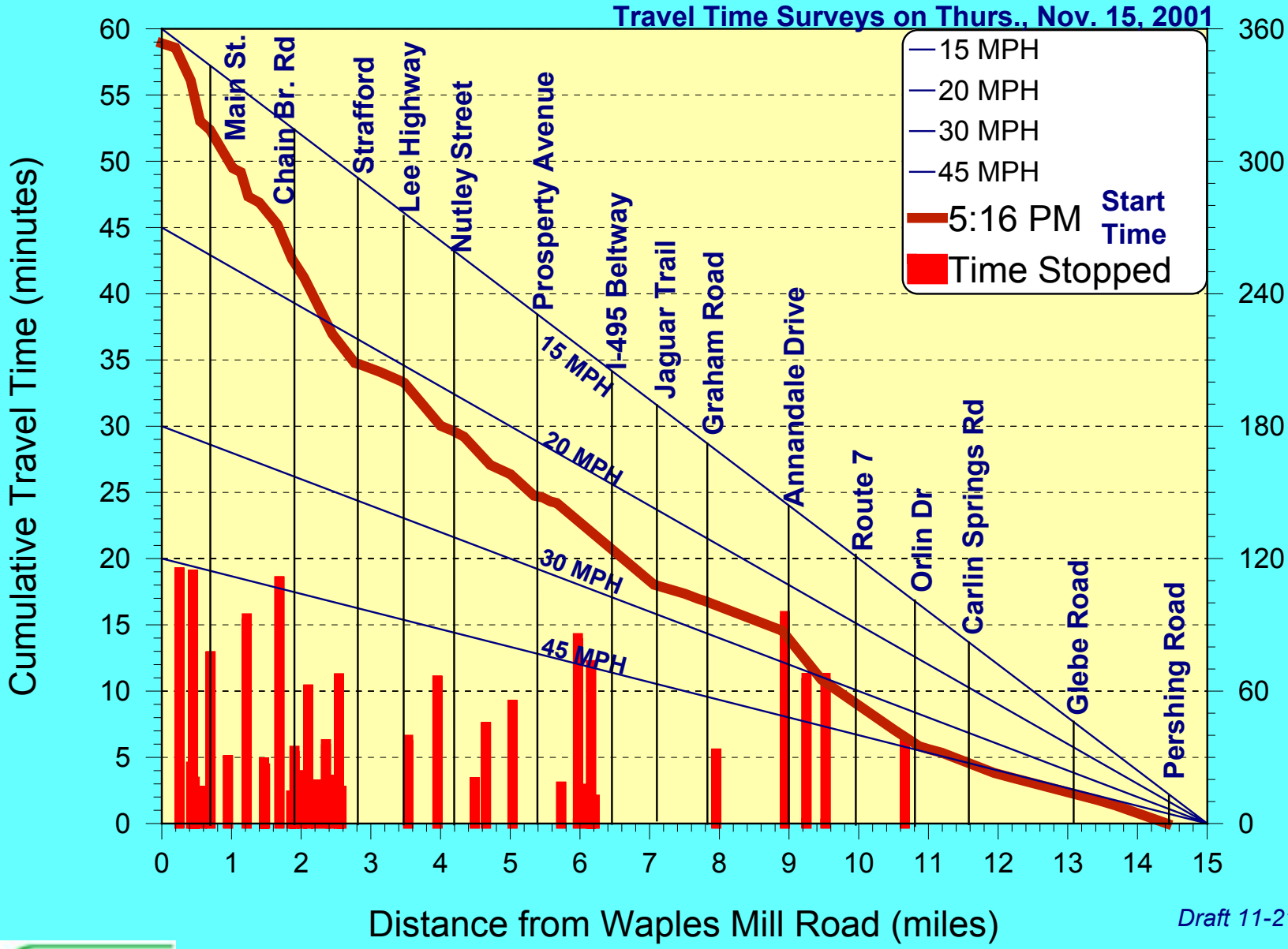
US 50 Travel Times: Pershing Dr to Waples Mill Rd: Westbound



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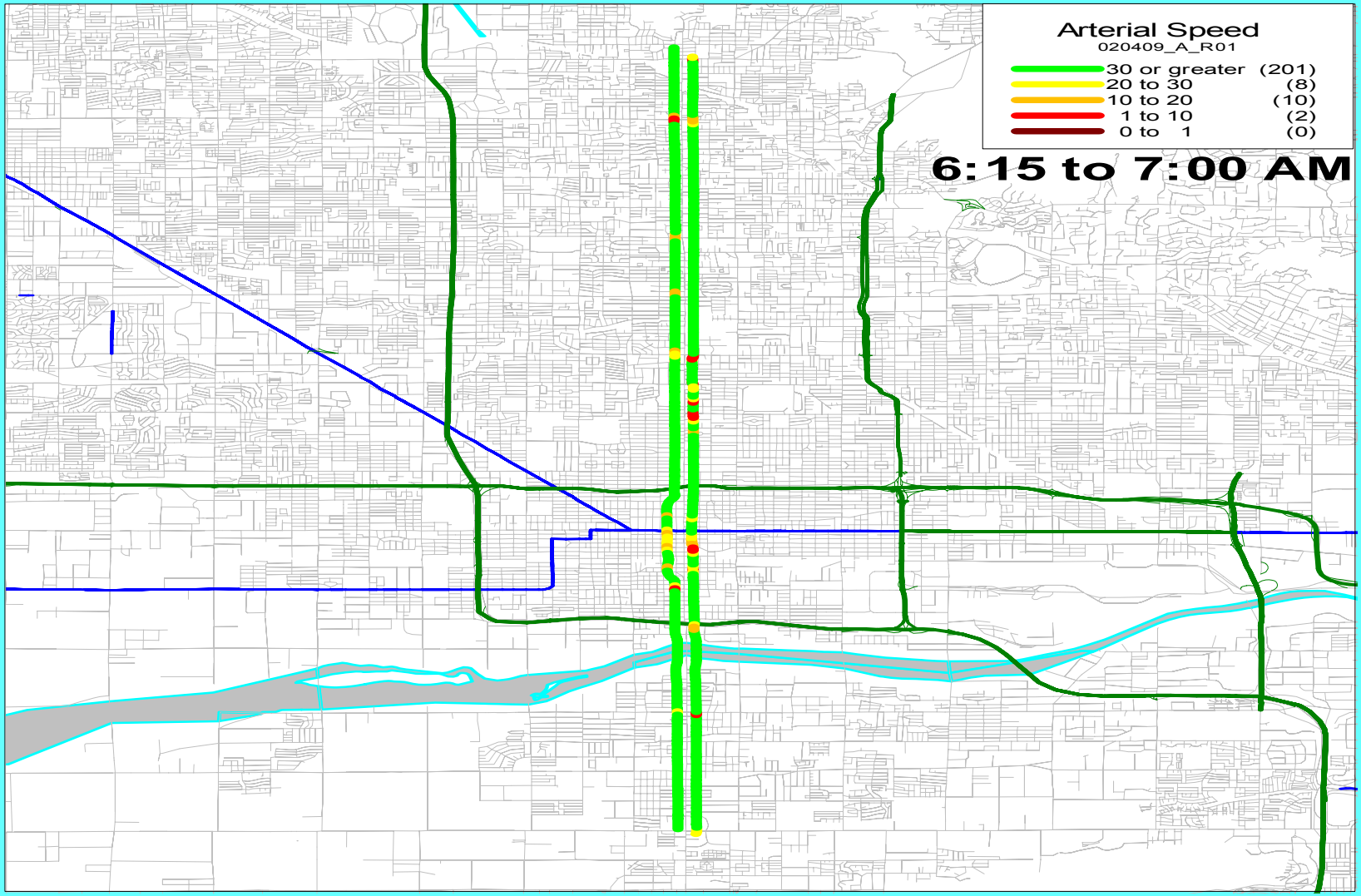
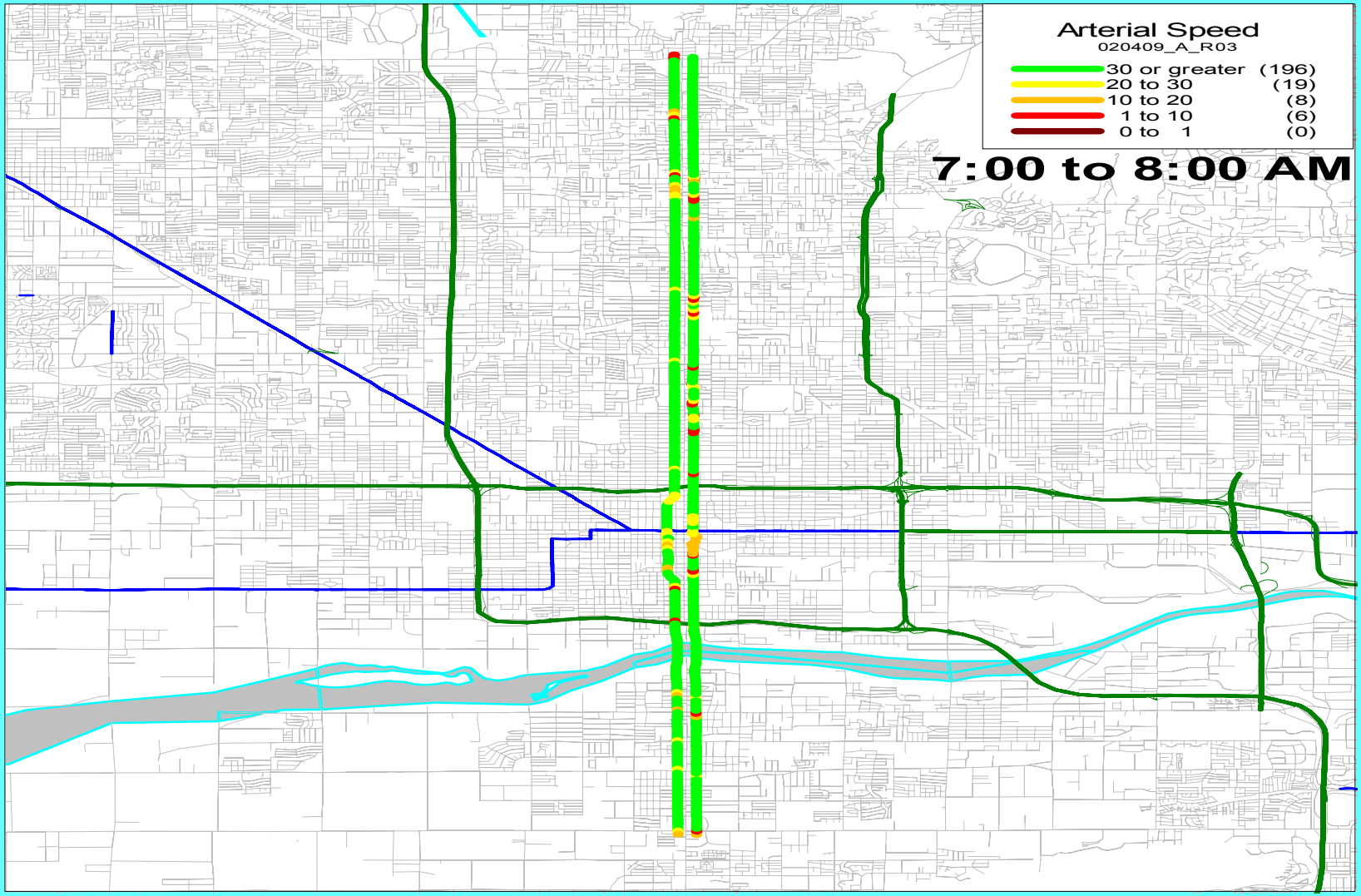
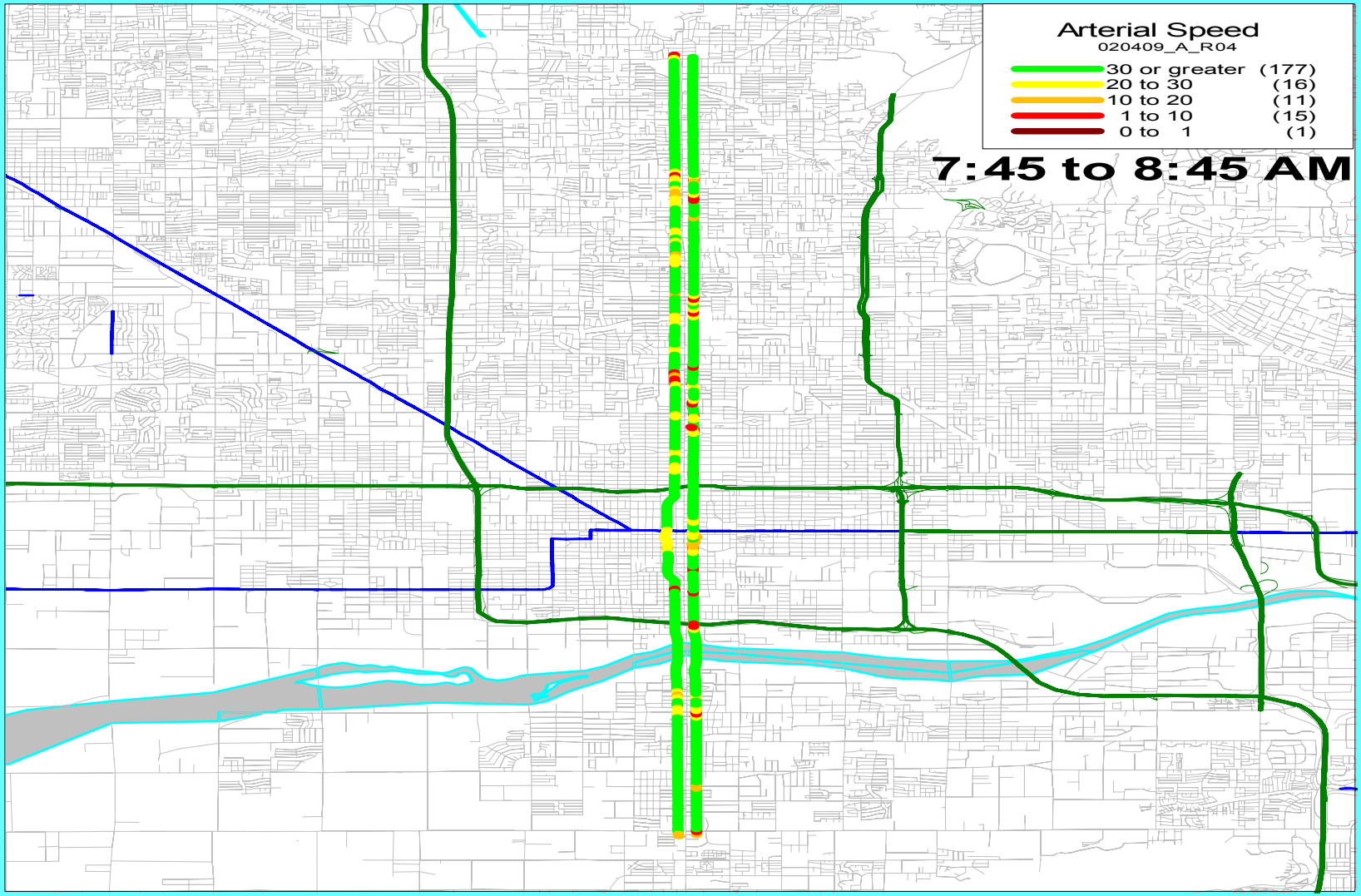

Arterial Speed
020409_A_R01
30 or greater (201)
20 to 30 (8)
10 to 20 (10)
1 to 10 (2)
0 to 1 (0)
6:15 to 7:00 AM


Arterial Speed
020409_A_R03
30 or greater (196)
20 to 30 (19)
10 to 20 (8)
1 to 10 (6)
0 to 1 (0)
7:00 to 8:00 AM


Arterial Speed
020409_A_R04
30 or greater (177)
20 to 30 (16)
10 to 20 (11)
1 to 10 (15)
0 to 1 (1)
7:45 to 8:45 AM

Household Travel Surveys: Key Benefits

- Determine
  - under-reporting of trips
  - trip rate correction factors
- Improve the accuracy of specific trip elements
  - trip start and finish time
  - origin and destination
  - distance
  - duration
- Obtain data on
  - route choice
  - highway functional class usage
    - time of day, trip purpose, and travel speed

Household Travel Surveys: Important Considerations for Implementation

- Length of deployment
  - multiple days improves accuracy
    - non-driving days
    - day-of-week variations
- Number of vehicles per household
- Participation rate
- Participant-installed or technician-installed
- Participant's Primary Language

Household Travel Surveys: Study Implementation

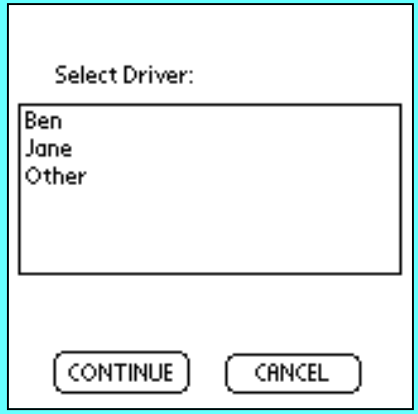
- Recruitment and scheduling
- Pre-deployment telephone contact
- Device setup and deployment
- Installation (3-5 min.) and use
- Return of equipment
- Uploading GPS and survey data
- Data processing
- Analysis

Household Travel Surveys: Entering Data

- Turn on vehicle, then PDA
- Press ‘START’
- Never need to enter data while vehicle is in motion

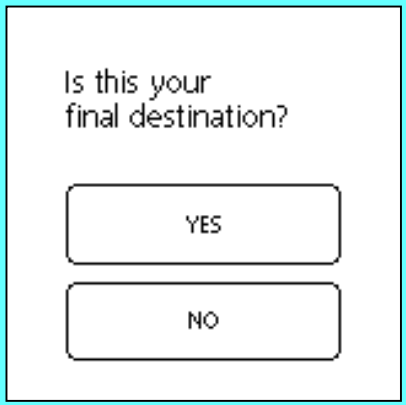
Household Travel Surveys: Entering Data

- Select driver from pre-populated list
- Select any passengers, if any, from pre-populated list
- Stow PDA and begin driving



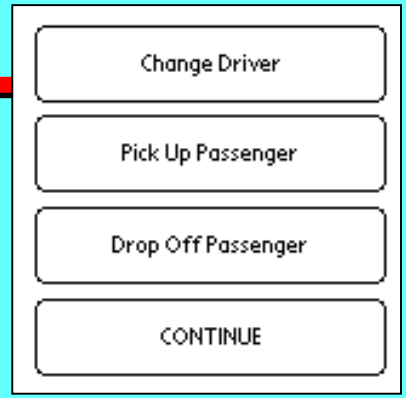
Household Travel Surveys: Entering Data (cont.)

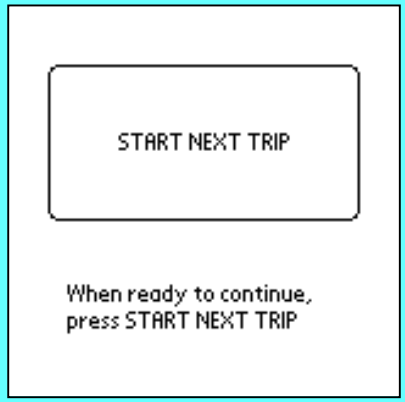
- Stop vehicle and select ‘END TRIP’
- Select trip purpose for each occupant (will vary for each survey)
- Indicate whether you are at your final destination or an intermediate stop



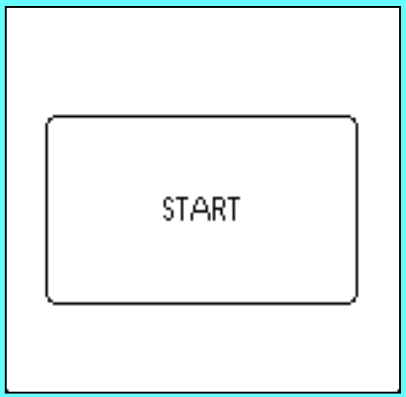
Household Travel Surveys: Entering Data (cont.)

- For intermediate stops, indicate whether
  - there is a change in driver
  - you picked up a passenger
  - you dropped off a passenger





- Otherwise, device is ready for next trip



Household Travel Surveys: Sample Summary Data

Admin Time: 02/02/01 16:38:54

Device ID: 2	Timer: 0 min	GPS Sample Rate: 1 sec	GPS Powered: At Power-On	Application: Personal Travel Survey
Source: Ignition	Idle Speed: 6 km/hr	Analog Sample Rate: 0 sec	PDA Powered: At Power-On	Micro Version: 2.00
	Idle Time: 30 sec	Idle Sample Rate: 30 sec	GPS Type: Standard	PDA Version: 1.00p

Chain Number	Trip Number	Start Time	End Time	Number of GPS Records			Distance (miles)	Duration (min)	Occupants	Driver Purpose	PDA Trip	Import Flag
				Bad	Good	Speed > Idle						
1	1	02/02/01 19:18:24	02/02/01 19:33:33	0	503	462	5.34	15.15	2	5,9	Yes	0
2	1	02/02/01 19:35:56	02/02/01 19:41:11	1	150	109	0.69	5.25	3	4,28	Yes	0
3	1	02/02/01 21:05:59	02/02/01 21:11:21	0	149	122	0.94	5.37	3	1,2	Yes	0
	2	02/02/01 21:11:30	02/02/01 21:24:02	0	415	382	5.27	12.53	2	7,30	Yes	0
4	1	02/03/01 12:38:47	02/03/01 12:51:28	0	365	321	3.5	12.68	3	3,8	Yes	0
	2	02/03/01 12:52:10	02/03/01 14:08:53	11	2869	2858	66.71	76.72	3	5,10	Yes	0
5	1	02/03/01 16:43:08	02/03/01 18:47:33	11	1984	1736	28.75	124.42	6	1,2	Yes	0
6	1	02/03/01 18:51:10	02/03/01 20:09:31	8	2952	2911	65.26	78.35	3	7,30	Yes	0
7	1	02/04/01 10:19:10	02/04/01 10:28:38	0	327	299	3.99	9.47	2	10,11	Yes	0
8	1	02/04/01 12:00:00	02/04/01 12:11:18	0	402	338	3.98	11.3	2	7,30	Yes	0
9	1	02/04/01 15:42:49	02/04/01 16:01:37	23	634	562	11.45	18.8	2	3,7	Yes	0
10	1	02/04/01 16:21:45	02/04/01 16:35:06	2	433	393	8.16	13.35	2	3,8	Yes	0
	2	02/04/01 16:35:40	02/04/01 16:44:24	1	283	271	3.55	8.73	2	7,30	Yes	0
11	1	02/05/01 07:28:23	02/05/01 07:58:28	7	1113	1032	18.07	30.08	1	2,4	Yes	0

- Review of speed profile may reveal additional editing that is needed (e.g., trimming of start and end times, identification of intermediate stops)

Household Travel Surveys: Matching GPS and Interview Trips

- Sort both by time (and date) of day
- Compare start time, end time, trip duration, and trip distance for pairs of trips
- Use automated statistical algorithms to identify matches
- Analyst visually verifies matches and non-matches
- Create final dataset for statistical analysis

Household Travel Surveys: Analysis

- Analysis of Trips Using Unmatched Data
  - Vehicle Trip Rates
  - Household Trip Rates, based upon person level information
  - Travel duration of vehicle trips
  - Average number of household members per vehicle trips
- Matched Data
  - Estimated the average ratio of the number of GPS recorded trips to the number of CATI recorded trips

Vehicle Activity Surveys

- Unobtrusive data collection without the handheld unit
- GPS Leader senses vehicle ignition
- Powered by vehicle – don't have to worry about running down internal batteries
- Large data storage capacity can handle long-distance trips
- Allocate vehicle location properly to
  - air basins, counties, urban areas

Emission Modeling and Duty Cycle Studies

- Can measure:
  - starts and stops
  - acceleration and deceleration
  - cruising speeds
  - Ignition/power on/offs
- Understand how vehicle activity contributes to airborne emissions
- Understand how vehicles are typically driven to better understand issues relating to wear and tear
- Event port can receive data from external sensor (e.g., direct emissions measurement)

Fleet Performance/Operations Analysis

- Cheaper to rotate units among the fleet than to purchase and permanently install expensive telematics systems
- Understand:
  - how vehicles are typically being driven
    - speeds, aggressive starts and stops, etc.
  - how drivers choose their routes and other behavior